

Amendments to the Drawings:

The attached sheets of drawings include changes to Figs. 1, 2 and 5. These sheets, which include Figs. 1-8, replace the original sheets, including Figs. 1-8. In Figs. 1, 2 and 5, the top margins were corrected. No changes were made to the other figures.

Attachments: Replacement Sheets

REMARKS

Claims 55, 57, 59, 69, 70, 72 and 80-89 are pending in this present application. In the Office Action dated October 29, 2003, the Examiner rejected claims 55, 57, 59, 69, 70, 72, and 84-89 under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement. The Examiner withdrew the rejections of claims 85 and 88 under this heading in the Office Action dated June 23, 2003. Additionally, the Examiner rejected claims 85 and 88 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. The Examiner also rejected claims 55, 69, and 84-89 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,551,959, to Martin et al. ("Martin"). Finally, the Examiner rejected claims 57, 59, 70 and 72 under 35 U.S.C. 103(a) as being unpatentable over the Martin reference as applied to claims 55 and 69, respectively, further in view of U.S. Patent No. 6,069,080, to James et al. ("James"). Applicants disagree with these grounds of rejection and wish to clarify various distinctions of Applicants' invention over the cited art. Reconsideration of the invention is therefore requested in light of the following amendments and remarks.

With regard to the Examiner's rejections under 35 U.S.C. 112, first paragraph, claims 55 and 69 have been amended to remove reference to "inorganic" material, and the term "rigid" has been added to provide clarity with respect to the term "hard". With regard to the Examiner's rejections under 35 U.S.C. 112, second paragraph, claims 85 and 88 have been amended to remove the term 'generally'.

The disclosed embodiments of the invention will now be discussed in comparison to the prior art. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the prior art subject matter, do not define the scope or interpretation of any of the claims. Instead, such discussed differences are offered merely help the Examiner appreciate important claim distinctions as they are discussed thereafter.

The various embodiments of the present invention are directed to polishing pads, apparatuses and methods for making polishing pads used in the manufacture of microelectronic devices. In an embodiment of the invention, a polishing pad has a backing member including a

first surface and an opposing second surface. A plurality of pattern elements are distributed on the first surface of the backing member, and a hard cover layer is then applied over the pattern elements, and at least over a portion of the backing member. The pattern elements thus define a plurality of contour surfaces that project away from the first surface of the backing member. The cover layer at least substantially conforms to the contour surfaces of the pattern elements to form a plurality of hard nodules on the backing surface. The hard nodules further define abrasive elements to contact and abrade material from a microelectronic device substrate assembly. Accordingly, the cover layer defines at least a portion of a planarizing surface of the polishing pad. The cover layer may be comprised of various hard, rigid materials, such as silica nitride, ceria, silica, alumina, titanium nitride, titania, zirconia or other suitable metallic or ceramic materials.

In a pertinent embodiment of the present invention, a polishing pad is manufactured by non-adhesively depositing a plurality of pattern elements over the first surface of the backing member and then depositing the hard inorganic cover layer over the pattern elements to retain the pattern elements on the backing layer. As discussed in detail in the specification, this approach avoids many of the difficulties encountered in the use of resinous, polymeric binding materials commonly used in prior art polishing pads. For example, as discussed at page 13, lines 10-15, "...the use of a resin binder that holds the abrasive particles may deteriorate or otherwise wear down as the front face of the substrate assembly grinds against the abrasive surface...[so that] the cover layer is expected to be less susceptible to mechanical and chemical wear than the resin binder in existing pads..." (page 13, lines 10-18).

The pattern elements may be deposited onto the first surface of the backing member by drawing or pulling the backing member through a bath having a liquid having a plurality of the pattern elements suspended in the liquid, and then evaporating the fluid from the pattern elements and the backing member, leaving a plurality of pattern elements non-adhesively distributed on the first surface of the backing member. The hard cover layer may then be deposited over the pattern elements using a chemical vapor deposition process, plasma vapor deposition, or other similar processes to retain the pattern elements on the backing member.

The Examiner cites the Martin reference. Martin discloses an abrasive article having a sheet-like substrate that supports a plurality of abrasive particles and a hard carbon

coating layer. With reference to Figure 1 of Martin, a substrate 12 supports abrasive particles 15 that are retained on the substrate 12 by a make coat 14. The abrasive particles are deposited onto and into the make coat..." (col. 7, lines 6-7) "...in partially embedded form to form an abrasive coating." (col. 7 lines 18-20). The make coat consists of a material that is "...based preferably upon organic, thermosetting polymers, although thermoplastic polymers also can be used." (col. 7, lines 63-67). The applicants thus understands the make coat to *adhesively* bind the abrasive particles to the underlying substrate prior to the application of a hard carbon coating layer 16 that is applied onto the abrasive particles 15 and the make coat 14. In contrast, the various embodiments of the applicants' invention deposit the pattern elements directly onto the substrate without embedding the particles into a resinous and polymeric make coat material. Thus, the hard cover layer generally covers the pattern elements, and contacts at least a portion of the substrate material.

The Examiner asserts that the abrasive particles 15 of Figure 1, when combined with the embodiment shown in Figure 4 anticipates the disclosed invention. Although not explicitly stated, it appears that the Examiner is motivated to combine elements from the two different embodiments because the abrasive composites 46 shown in Figure 4 are positioned directly on the backing material 42 so that the particles 15 of Figure 1 are not embedded in a make coat material. Although this may be the case, the abrasive composites 46 are still adhesively bonded to the backing material with a polymeric material. Applicants point to U.S. Patent No. 5,435,816 to Spurgeon et al. ("Spurgeon") which is incorporated by reference in Martin for this teaching. Specifically, Spurgeon states that the mixture used to form abrasive composites (e.g. the abrasive composites 46 in Figure 4 of Martin) comprises a plurality of abrasive particles dispersed in a binder precursor. The binder precursor may include acrylated urethanes, acrylated epoxies as well as other similar materials which are capable of being cured by exposure to radiant energy. The Examiner is directed specifically to columns 4 through 5 of the Spurgeon reference for this teaching.

The Martin reference therefore does not disclose or even fairly suggest depositing the pattern elements onto the substrate surface, wherein the pattern elements are covered by a non-polymeric material that also contacts a portion of the substrate.

The Examiner has further cited the James reference. James discloses a method for manufacturing a fixed abrasive polishing pad by dispersing solid abrasive particles in an aqueous solution of a resin binder and spraying the solution onto a supporting substrate. The resin binder may then be polymerized by exposure to thermal or electromagnetic energy (col. 12, lines 25-35). Accordingly, applicants respectfully asserts that James also teaches adhesively bonding the abrasive particles to a supporting substrate, even though the application process may include spraying the particles and resin binder onto the supporting substrate.

Turning now to the claims, patentably-distinct differences between the claims and the applied references will be specifically pointed out. Claim 55, as amended, recites in pertinent part, “A method of manufacturing a polishing pad for planarization of a microelectronic-device substrate assembly, comprising...*covering the contour surfaces with a cover layer of a hard, rigid non-polymeric material that contacts portions of the first surface of the backing member and conforms to the contour surfaces to form nodules from the portions of the hard cover layer*...” (Emphasis added). The Martin reference does not disclose this. Instead, Martin discloses a diamond like carbon layer that does not contact the substrate while also covering the abrasive or pattern elements. Claim 55 is therefore allowable over the cited art. Claims depending from claim 55 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited therein.

Claim 69, as amended, recites in pertinent part: “A method of manufacturing a polishing pad for planarization of a microelectronic-device substrate assembly, comprising...*forming a layer of a hard and rigid non-polymeric material on the pattern elements to conform to the contour surfaces, the layer of hard, rigid non-polymeric material also contacting at least a portion of the polymeric backing member*...” (Emphasis added). Again, Martin does not disclose this. Claim 69 is therefore allowable over the cited art. Claims depending from claim 69 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited therein.

With regard to the Examiner’s rejections under 35 U.S.C, § 103(a), applicants respectfully assert that the foregoing amendments also address this basis for rejection, since the rejection is based on the Martin reference in combination with other references.

With regard to Examiner's request for corrected drawings, attached are corrected figures 1, 2 and 5 submitted in replacement sheets 1-4.

All of the claims remaining in the application are now clearly allowable.
Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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Enclosures:

Postcard
Fee Transmittal Sheet (+ copy)
4 Sheets of Drawings (Figs. 1-8)

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